

Application No. 10/779,086

RD-29430-2

REMARKS

Applicant appreciates the consideration shown by the Office as evidenced by the Office Action mailed on July 1, 2005. In the subject Office Action, Claims 4, 7 and 9 were rejected, claims 1-13 were rejected, and claim 13 was objected to. Applicants respectfully request reconsideration of the application by the Examiner in light of the above amendments and the following remarks.

Claim Objections

Claim 13 is objected to because of the following: Claim 13 is directly depending upon claim 1. Claim 1 has a limitation "said at least a heat sink covering said at least a removed portion and less than an entire surface of said flexible dielectric film. Claim 13, which depends from claim 1, has a limitation "said body (said heat sink body) covering substantially an entire surface of said dielectric film opposite to a surface on which circuit traces are disposed". The Office Action stated that these two limitations in one claim (claim 13) are misleading. Applicant has amended claim 13 so as to remove the limitation stating that the heat sink body covers "substantially an entire surface of said dielectric film opposite to a surface on which circuit traces are disposed." Applicants submit that claim 13 is not contradictory or confusing in light of claim 1. As such, Applicant requests that the objection to claim 13 be removed.

Rejections under 35 U.S.C. §102

Claims 1-7, 12 and 13 are rejected under 35 USC 102(b) as being anticipated by US Patent No. 5,452,182 issued to Eichelberger et al. (hereinafter "Eichelberger").

Amended claim 1 is drawn to a flexible interconnect structure and recites:

a flexible dielectric film having two opposed surfaces, at least a portion of said dielectric film being removed through a thickness thereof, forming a plurality of removed portions;

circuit traces disposed on at least one of said opposing surfaces; and

a plurality of heat sinks coupled to a surface of said dielectric film, each of said plurality heat sinks covering a

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corresponding one of a plurality of removed portions and less than one of said opposing surface of said flexible dielectric film, such that the interconnect structure remains flexible.

Thus, the flexible interconnect structure of claim 1 includes a flexible dielectric film having a **plurality of removed portions** formed through a flexible dielectric film. Additionally, the flexible interconnect structure includes a plurality of heat sinks coupled to a surface of said dielectric film, where **each of the plurality heat sinks covers a corresponding one of a plurality of removed portions** and less than one of said opposing surfaces of said flexible dielectric film, **such that the interconnect structure remains flexible**. Moreover, in paragraph [0021] of the specification, Applicant has defined the term "heat sink" to refer to a structure or component that transports heat away or otherwise removes heat from a heat source. Additionally, Applicant has defined the term "flexible" to mean being capable of being bent to a shape that has a radius of curvature of less than about 10cm, and preferably less than about 1cm.

Although Eichelberger describes a flexible high density interconnect structure and system, Applicant submits that Eichelberger does not teach or otherwise suggest each and every element of amended claim 1. In particular, the system (10) of Eichelberger includes a single substrate 14 described as an electrically insulating thermally conducting substrate which covers multiple via holes formed through a dielectric layer (32). Even if the single substrate 14 of Eichelberger could be considered to function as a heat sink, it is clear from Figure 1 that a single substrate 14 covers multiple via holes through which chips 20 are connected. Thus, it cannot be said to be the same as "a plurality of heat sinks coupled to a surface of said dielectric film, where each of the plurality heat sinks covers a corresponding one of a plurality of removed portions".

Furthermore, claim 1 recites that the claimed elements of interconnect structure are arranged such that the interconnect structure remains flexible. However, Eichelberger states that the portion (38) of the interconnect structure...is a *rigid structure* which is firmly adhered to the substrate and chips (see e.g., column 8; lines 52-56). Additionally, Eichelberger states that to the left and the right of the substrate (14) the interconnect structure portions 39 are flexible which further emphasizes that

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portion 38 is not flexible. Moreover, although Figures 18 and 19 of Eichelberger appear to illustrate a flexible array of components, Eichelberger explicitly states that "the high density interconnect structure 30 which has been rendered flexible by removal not only of the carrier and any support members, but also by removal of the substrates 14 to leave just the electrical components connected to the high density interconnect structure 80 (see column 16; lines 9-15). In fact, for Eichelberger to obtain such a structure as that shown in Figures 18 and 19, the heat sink function is achieved through circulation of a coolant through a shared cooling conduit (see e.g., Fig. 19) and not through a plurality of heat sinks as claimed. For at least these reasons, Applicant submits that Eichelberger does not anticipate amended claim 1. As such, Applicant requests that the rejection to claim 1 be removed and the claim be allowed.

As claims 2-7, 12 and 13 depend directly or indirectly from claim 1, Applicant submits that claims 2-7, 12 and 13 are allowable for at least the reasons set forth above with respect to claim 1.

Claims 1-7, 12 and 13 are rejected under 35 USC 102(b) as being anticipated by US Patent No. 4,563,725 issued to Kirby (hereinafter "Kirby"). As with Eichelberger, Applicant submits that Kirby does not teach or otherwise suggest each and every element of amended claim 1. Kirby teaches an electrical assembly comprising a multiplicity of rigid slab-like heat dissipating components (see e.g., column 2; lines 66-68). In particular, Kirby teaches a substantially rigid thermally conductive plate 16 and a plurality of upstanding heat sink pillars 17 where the pillars 17 are inserted through holes 15 in flexible laminate 1. Moreover, Kirby's system includes a substantially rigid plate 8 applied to the top of components 4 thereby forming a rigid structure (see e.g., column 7; lines 1-12). Applicant submits that not only does Kirby not teach or otherwise suggest an **interconnect structure that remains flexible**, Kirby further does not teach or otherwise suggest a **plurality of heat sinks coupled to a surface of the dielectric film, where each of the plurality heat sinks covers a corresponding one of a plurality of removed portions and less than one of said opposing surfaces of said flexible dielectric film**. Even if one were to interpret heat sink pillars 17 of Kirby as being a plurality of heat sinks, Applicant submits that the heat sink pillars 17 are not coupled to a surface of the dielectric film but rather to the substantially rigid plate 16 on one side and to components 4 on the other side. For at least the

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reasons set forth above, Applicant submits that Kirby does not anticipate amended claim 1. As such, Applicant requests that the rejection to claim 1 be removed and the claim be allowed.

As claims 2-7, 12 and 13 depend directly or indirectly from claim 1, Applicant submits that claims 2-7, 12 and 13 are allowable for at least the reasons set forth above with respect to claim 1.

Rejections under 35 U.S.C. §103

Claims 8-11 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Eichelberger as applied to claim 1 above and further in view of US Patent No. 5,920,458 issued to Azar (hereinafter "Azar"). Azar is cited for teaching a printed circuit board assembly with an enhanced cooling via a heat sink having fins for enhancing the heat dissipation. Whether or not Azar teaches that which it is cited for teaching, Applicant submits that Azar does not cure the deficiencies of Eichelberger. That is, the combination of Eichelberger and Azar still do not teach or otherwise suggest a flexible interconnect structure comprising a flexible dielectric film having a plurality of removed portions formed through a flexible dielectric film, and a plurality of heat sinks coupled to a surface of said dielectric film, where each of the plurality heat sinks covers a corresponding one of a plurality of removed portions and less than one of said opposing surfaces of said flexible dielectric film, such that the interconnect structure remains flexible. As such, Applicant submits that claims 8-11 are patentable over Eichelberger in view of Azar.

Claim 5 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Kirby as applied to claim 1 above and further in view of US Patent No. 5,506,756 issued to Haley (hereinafter "Haley") and US Patent No. 5,285,352 issued to Pastore et al. (hereinafter "Pastore"). Whether or not Haley and Pastore teach that which they are cited for teaching, Applicant submits that Haley and Pastore do not cure the deficiencies of Kirby. That is, the combination of Kirby with Haley and Pastore still do not teach or otherwise suggest a flexible interconnect structure comprising a flexible dielectric film having a plurality of removed portions formed through a flexible dielectric film, and a plurality of heat sinks coupled to a surface of said dielectric film, where each of the plurality heat sinks covers a corresponding one of a plurality of removed portions and

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less than one of said opposing surfaces of said flexible dielectric film, such that the interconnect structure remains flexible. As such, Applicant submits that claim 5 is patentable over Kirby in view of Haley and Pastore.

Claims 8-11 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Kirby as applied to claim 1 above and further in view of Azar. Once again, Applicant submits that whether or not Azar teaches that which it is cited for teaching, Azar does not cure the deficiencies of Kirby. That is, the combination of Kirby and Azar still do not teach or otherwise suggest a flexible interconnect structure comprising a flexible dielectric film having a plurality of removed portions formed through a flexible dielectric film, and a plurality of heat sinks coupled to a surface of said dielectric film, where each of the plurality heat sinks covers a corresponding one of a plurality of removed portions and less than one of said opposing surfaces of said flexible dielectric film, such that the interconnect structure remains flexible. As such, Applicant submits that claims 8-11 are patentable over Kirby in view of Azar.

In light of the amendment and remarks presented herein, Applicant submits that the case is in condition for immediate allowance and respectfully requests such action. If, however, any issues remain unresolved, the Examiner is invited to telephone the Applicant's counsel at the number provided below. The Director is hereby authorized to charge any additional fees that may be required to Deposit Account 07-0868.

Respectfully submitted,



Jason K. Klindtworth
Attorney for Applicant
Registration No. 47,211

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General Electric Company
1 River Road
Building K1, Room 3A65
Niskayuna, New York 12309
Telephone: (518) 387-7360 or
(518) 387-7122